

**EFFECT OF MOBILE BANKING ON COST EFFICIENCY OF  
COMMERCIAL BANKS IN KENYA**

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**A RESEARCH PROJECT SUBMITTED IN PARTIAL  
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## **DECLARATION**

I, the undersigned, declare that this is my original work and has not been presented to any institution or university other than the University of Nairobi for examination.

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This research project has been submitted for examination with my approval as the University Supervisor.

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Quoting the words of Shannon L Adler, "When you invite people to share in your miracle, you create future allies during rough weather". This quote is a true reflection of my journey writing this research project because without the individuals involved, this journey would have been impossible.

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## **DEDICATION**

I dedicate this project to my Dad James Muthii, Mum Nancy Muthii and Wife Nimo Wachira. They have been my inspiration to achieve my dreams. Through their motivation and prayers for my success I have been able to complete this project and for that I am grateful.

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## **LIST OF ABBREVIATIONS**

<b>ATM</b>	Automated Teller Machine
<b>CBK</b>	Central Bank of Kenya
<b>CBS</b>	Core Banking Solution
<b>ICT</b>	Information, Communication & Technology
<b>NSE</b>	Nairobi Securities Exchange
<b>ROA</b>	Return on Assets
<b>TAM</b>	Technology Acceptance Model

## ABSTRACT

The advancement in technology has made some tasks cheaper and efficient but it also has its fair share of challenges. This has seen firms in the banking sector use technology to develop online banking channels to reduce costs and enhance efficiency and convenience but still fail. This study sought to establish the effect of mobile banking on cost efficiency among commercial banks in Kenya. 42 commercial banks in operation in Kenya as at 31<sup>st</sup> December 2018 were the population of the study. Data from 38 banks was availed for the study which was 90.48% response rate. The predictor variables were mobile banking, bank size, asset quality and liquidity. Cost efficiency was the dependent variable. Secondary data was acquired for 5 years (January 2014 to December 2018) on an annual basis. Research design was descriptive cross-sectional design whereas association between variables was determined by multiple linear regression model. SPSS version 22 was used in data analysis. An R-square value of 0.345 that can be translated to mean 34.5% of the variations in cost efficiency among banks in Kenya can be related to the four chosen predictor variables whereas 65.5% in the changes of cost efficiency among banks was linked to other variables that did not form part of this study. From the study it was further revealed that the predictor variables strongly correlated with cost efficiency ( $R=0.582$ ). ANOVA results show that the F statistic was significant at 5% level with a  $p=0.000$ . Therefore, the model was appropriate in providing an explanation of the relationship between the variables. Additionally, results demonstrated that mobile banking and liquidity were positively and statistically substantial values in the study. Asset quality was found to have a negative and statistically significant influence on cost efficiency. The study discovered that bank size have a statistically insignificant influence on cost efficiency of banks. The recommendation is that measures should be set up to increase mobile banking and liquidity and to reduce credit risk as these three have a significant influence on cost efficiency.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

Over the years technology has had a significant impact on how banks operate and formed bedrock upon which banks individuate their products from competitors. The products are provided through electronic intermediaries such as automated teller machines, cellular devices and the internet. Banks regularly depend on modern technology for customer service to satisfy their banking needs (Kolodinsky, Hogarth & Hilgert, 2004). From a glance, it is clear that majority of banks have tried to apply alternative banking channels to improve operational efficiency (Ren & Stevens, 2011). According to Nofie (2011), innovation in the financial sector pertains to new, better processes lowering cost of producing existing financial services. According to Agboola (2006), mobile banking is a key component to banking development in financial emergency.

This study drew support from a number of theories such as the diffusion of innovation theory, technology acceptance model, and the financial intermediation theory that have attempted to elaborate the relationships between cost efficiency of banks and mobile banking. Mises (1912), developed the Financial intermediation theory which pose that financial institutions have a critical role where they gather deposits and lend them out to get interest thus for them to boost their performance, they have to enhance deposits from their clients through creation of ways that would make it easy and convenient for customers to transact. Diffusion of innovation is how a new idea is communicated to members of a certain social system using a selected preference channel (Rogers, 1995). Technology Acceptance Model (TAM) clarifies the way

clients embrace and make use of an innovative idea. In this study, TAM will be applied find out how technology acceptance influences internet banking among commercial banks in Kenya.

In Kenyan banking sector, a lot of dynamism is being witnessed in the business environment which has been attributed to increased technological growth, competition and globalization. Commercial banks have embraced the use of mobile so as to reduce their operational costs. Ngaruiya (2014) states that adoption of mobile money transfers was perceived as tool which improves the manner in which financial transactions are undertaken. This implies that the rapid adoption of mobile phones uplifted this sector's financial functionality. A positive factor about mobile phones is their networks transmission is at lower costs even in the secluded regions; and has made financial transactions to be undertaken in a faster and simple manner from any place as long as mobile money services are available.

### **1.1.1 Mobile Banking**

According to Anyasi and Otubu (2009), mobile banking has been described a service provided by mobile service providers in collaboration with financial institutions. Mobile banking is any transaction that entails the transfer of rights or ownership to use particular services or goods, using mobile access to computer- mediated networks through an electronic device (Tiwari, Herstatt & Buse 2006). Hans and Kamath (2013) also defines mobile banking as being the emanation of financial products or services, new organizational forms or new undertakings that will result in more developed and complete financial markets that will aid in the reduction of both costs

and risks or provide services that meet particular needs of players in a financial system.

Mutua (2010) argues that technological advancement has led to online banking and mobile banking that has consequently led to change in criteria for carrying out business by commercial banks. Mobile banking brings convenience and removes geographical limitation to consumers. Through mobile banking, banking can be undertaken throughout in any place and day and the security and management of cash is enhanced. Access to their accounts by use of personal phones and computers with convenience hence the banks become efficient as service provider.

Mobile banking reduces the turn-around time, which is the time a customer takes to be served, from about 10 -15 minutes to about 2 minutes. Adoption of mobile banking helps in minimizing the operational costs and in being efficient and effective as service provider. The banks saves the cost of opening new branches because mobile banking enables bank reach customers and penetrate new markets. Mobile banking enables the banks to maximize the income collection that is not supported by any funding (Sheleg & Kohali, 2011). Previous studies have operationalized mobile banking in terms of either number of online transactions or value of the transactions. In this study, natural logarithm of the total value of customer transactions via mobile banking will be used to measure the usage of mobile banking by commercial banks' customers.

### **1.1.2 Cost Efficiency**

Sandrine (2010) defines cost efficiency as being related to the ability to produce a desired outcome using minimum effort or resources. It ascertains the extent to which a

production unit gets close to its production possibility frontier, which constitutes the points that optimally combine inputs so as to produce one output unit. Floros and Giordani (2008) say that cost efficiency is considered as a relative measure that shows the deviations from the expected output using a given set of input. Charnes, Rhodes and Coopers (1978) define cost efficiency as the ratio of weighted outputs to the weighted inputs.

Cost efficiency refers to both allocative and technical efficiency and it provides the proximity to which the bank's actual cost is in comparison to what it would be under best-practice in creating a similar output while maintaining the same conditions. Technical efficiency measures the capacity of a firm to maximize its output at a constant level of inputs while allocative efficiency refers to the use of inputs by a firm in optimal proportions (Kalluru & Bhat, 2009). Alternatively, profit efficiency measures the degree to which a firm's profits fall below the expected profits. Profit efficiency combines both revenues and costs to measure efficiency. Most performance evaluation studies are based on cost efficiency measures (Darrab & Khan, 2010).

To assess cost efficiency, the study embraced the view of Shaffer (2012) who contended that effective cost (expenses) administration is a significant cause of bank profitability. Operating expenditures alone were regarded as the result of proper bank managing i.e.  $\text{Cost efficiency} = \frac{\text{Total revenue}}{\text{Total expenses}}$ , hence it is commonly quantified by the ratio of overall revenue to total operating expenses since poor expenses running are the chief factor to the poor performance (Shaffer, 2012). The ratio measures the number of times that revenues cover expenses.

### **1.1.3 Mobile Banking and Cost Efficiency**

Through mobile banking, millions of people who own mobile phones in emerging markets are able to participate in the financial mainstream. According to CGAP (2006), Mobile banking increases access to financial services by reducing the bank's own transaction costs and overheads and minimizing distance and time to the nearest retail bank branches. Through mobile banking, financial institutions offer new banking services to new clients thus expanding their market (Lee & Kim 2007). E-banking is largely driven by operating revenues maximization and the prospects of operating costs minimization prospects (Simpson 2002). Online banking comparison in emerging and developed markets shows that higher revenues and lower costs are incurred in developed markets.

With reference to Harker and Zenios (2000), it's stated that technological advancement encourages more competitive force. Primarily, it opens up new conveyance channels, keeping in mind that those are not more cost effective for the organization; hence customers get the chance to rely on them and demand access. Nevertheless, before the bank branch was the main channel for the dispersion of financial services, we see today an assortment of channels eroding the branch's dominance. The economies of scale that lead to more incorporated automation cause more economies of scope effects. As financial establishments – in concurrence with all other retail services – understand that consumer satisfaction and loyalty lead to a fixed progression, they go for increasing the share of customers' wallets that they are servicing. With stage automation, a representative can get a single view of the whole customer relationship; economies of scope can be made when a firm offers appropriate product mix to support its customer base.

Gale and Allan (1994) opposed advancement to remain noticed by means of: presentation of original economic devices and/or services and/or repetition, launching of original fund expenditures, discovering new wellsprings of funds, launching of original developments and/or methods towards handling everyday processes, and/or setting up an innovative organization; with every one of respective modifications to be a piece of present economic organizations, rise of remarkable development of innovative economic organizations and marketplaces. Financial advancement refers to making before promoting innovative economic devices, also inclusive of first-hand economic know-hows, organizations and marketplaces (Lerner & Tufano, 2011).

#### **1.1.4 Commercial Banks in Kenya**

Based on the Central Bank of Kenya directory, the population of commercial banks operating in the country is forty-three some of which are internationally based. The headquarters of these banks are in Nairobi and they serve both retail and corporate customers. The functions of the banks in the country include: money creation, savings, ensuring seamless flow of international transactions, supporting of payment systems, advancing credit and storage of valuable items. On the other hand, the function of CBK which is the regulatory body of the commercial banks is the formulation and execution of monetary policy, ensuring the commercial banks are liquid and they are operating properly. Out of the 43 banks, 31 are owned by locals and 13 by foreigners while 11 are listed at the NSE (CBK, 2017).

Many changes have been made in the banking sector to improve their way of operation and work on efficiency. These events include an increase in competition for financial services, banking consolidation and technological innovation. The banks



therefore are forced to focus more attention on areas enhancing efficiency such as providing services and products more efficiently and controlling costs in banking. The urge to reduce both administrative, operational costs and competition has led to the adoption of mobile banking by banks (Mutua, 2010). Ngaruiya (2014) states that adoption of mobile money transfers was perceived as tool which improves the manner in which financial transactions are undertaken. This implies that the rapid adoption of mobile phones uplifted this sector's financial functionality. A positive factor about mobile phones is the low cost of network transmission even in the remote regions; and has made financial transactions to be undertaken in a faster and simple manner from any place as long as mobile money services are available.

Commercial banks cost efficiency will ensure that the shareholders get a return to their investment which triggers more investment thus increased economic growth. Inefficiency on the other hand will lead to failure of financial market which may cause a financial crisis that hinders economic growth. Although there is a general register of good performance in the Kenyan banking industry, several banks are not doing well financially (Oloo, 2011). The industry's reforms such as mobile banking, payment systems introduction in e-commerce, operationalization of credit reference bureaus, the activation of horizontal repos and implementation of the Microfinance Act and will enhance the sectors growth and development (Adembesa, 2014).

## **1.2 Research Problem**

Financial inventions permit organizations to shape competences, endure competition so as to become a market leader. Financial innovations also provide new service delivery channels such as internet, mobile phones and third party agents that enable

the industry to remain competitive and reduce operating costs. The results of innovation thus give a temporary competitive edge that lead firms to achieve higher sales and firm growth (Schulz & Jobe, 2001). The advancement in technology has made some tasks cheaper and efficient but it also has its fair share of challenges (Aladwani, 2001). This has seen firms in the banking sector use technology to develop online banking channels to reduce costs and enhance efficiency and convenience but still fail (Kombe & Wafula, 2015).

Kenyan banks invest a lot in technology to address competitiveness, cost and revenue concerns. It also undertakes other activities that have short term effects on the bank's profitability. Other additional investments seek to put the banks at the fore front and to attain a competitive edge. The big question is whether there is comparative cost advantage by financial institutions which have adopted mobile banking from those who have not. Since 2008 KCB Bank group introduced a new IT system T24 from the previous TC3 system. The new system was a platform to support other internet banking such as Internet banking, Mobile Banking, ATM online services through introduction of VISA ATMs and Agency banking. Other Banks among them Cooperative bank, Equity Bank, Barclays Bank , Standard chartered, and last to adopt a new system National Bank, all this was done to facilitate smooth facilitation of online banking among other function. The main aim was to reduce cost of operation and increase revenue.

Several empirical studies have been carried out both locally and globally but most of them have not examined the effect of mobile banking on cost efficiency. Lyocsa and Pancurovad (2013) sought to establish the determinants of commercial bank

efficiency in Eastern and Central Europe. The study found out that the asset quality and capitalization of the bank is positively linked with cost and revenue efficiency. Venansius (2014) researched on utilization of technology to improve on service. He reasons that innovation is an instrument that ought to be abused to upgrade service conveyance in institutions that provide access to monetary services. It makes an upper hand as well as improves business development and steadiness. Stoica, Mehdian and Sargu (2015) studied how internet banking impacts on the performance of Romanian banks and concluded that e-banking provides efficient and lower cost services which increase banks' performance.

Locally, Shanyisa (2018) studied how the efficiency of commercial banks is affected by financial innovations in the Kenyan banking industry. The conclusion was that financial innovation had an insignificant impact on efficiency of banks. Chirah (2018) study on alternate channels of banking and their effect operational efficiency of banks in Kenya found out that operational efficiency was not significantly affected by mobile banking. Muli (2018) studied how electronic banking influenced efficiency of banks in Kenya and concluded that mobile banking significantly influences efficiency of banks. From the foregoing, it is clear that there is no consensus on the relationship between mobile banking and cost efficiency and this is the gap the current study leveraged on by answering the research question; what is the effect of mobile banking on cost efficiency of commercial banks in Kenya?

### **1.3 Objective of the Study**

The objective of this study was to determine the effect of mobile banking on cost efficiency of commercial banks in Kenya.

#### **1.4 Value of the Study**

The results of the research are of great importance to theory as it will help in developing theories on mobile banking and cost efficiency of commercial banks. The findings might also be significant to scholars and researchers, in identifying the research gaps on the related topics of the study as well as reviewing of the empirical literature to institute further areas of research.

The stakeholders of the banking industry and specifically the managers will find this research very useful as this study will generate vital information on how mobile banking influences efficiency of commercial banks in Kenya. The management of the banks will derive the most out of this since it illuminates ways in which they can utilize mobile banking as a channel to improve cost efficiency in their banks.

To the government and other policy makers, this study's findings will help them to guide and formulate policies and guidelines that would assist commercial banks and other banks in the sector adopt mobile banking that will enhance their cost efficiency and therefore contribute to the sector performance.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Introduction**

A review of theories which form the foundation of this study will be presented in this section. In addition, previous research carried before on this research topic and related areas are also discussed. The other sections of this chapter include determinants of cost efficiency, conceptual framework showing the relationship between study variables and a literature review summary.

### **2.2 Theoretical Framework**

This presents review of the relevant theories that explains the relationship between mobile banking and cost efficiency. The theoretical reviews covered are financial intermediation theory, diffusion of innovation theory and technology acceptance model.

### **2.2.1 Financial Intermediation Theory**

The financial intermediation theory was advanced by Mises (1912) and postulates that financial institutions especially banks play a significant role in financial intermediation. The banks play the role of mobilizing customers with surplus money and availing them for lending to those with a shortage at a cost commonly referred to as interest. This association allows the banks to create a state of liquidity since money is taken from customers with short term maturity funds and advanced to customers with long term maturity basis (Dewatripont, Tirole & Rochet, 2010). Mises (1912) argues that the banks' role as credit negotiators is characterized by lending borrowed money.

Financial intermediation through borrowing and lending money can thus be described as the key role of the banks. According to Mises (1912), involvement in financial intermediation by banks denies them the role of creating money while retreating from the process presents them with a chance to create money. However Allen and Santomero (2001) criticize the theory on grounds that it perceives risk management as an emerging factor in the financial sector and puts the concept of participation costs at the front line. This theory is applicable to the study since bank cost efficiency could be enhanced by improving customer deposits through development of mobile banking that will facilitate easy and convenient undertaking of bank transactions by the customers.

### **2.2.2 Diffusion of Innovation Theory**

Rogers (1995) was the pioneer of this theory. According to Mahajan and Peterson (1985), an innovation is any idea, practice or object that is that is introduced into a

social system for the first time whereas innovation diffusion is the process through which the innovation is relayed by the use of selected channels over a period of time within a social system. In this context, this theory seeks to describe the manner in which new inventions such as mobile banking and internet banking are adopted and used within a social system (Clarke, 1995).

According to Sevcik (2004), the innovation adoption process is not instant but takes time. He further argues that diffusion of innovation is influenced by resistance to change since it slows down the innovation adoption process. Innovation adoption process is influenced by five major attributes namely relative advantage, compatibility, complexity, observability and triability (Rogers, 1995). Rogers argues that the level of new innovations adoption depends on the manner in which new organization perceives its relative advantage, triability, compatibility, complexity and observability. If a Kenyan organization observes the benefits of internet banking, then this innovation will be adopted when other prerequisite tools are available. Innovation adoption is faster in organizations with information technology departments and internet access as opposed to those without. The theory relates to the current study as it explains how innovations such as mobile banking are adopted in organizations.

### **2.2.3 Technology Acceptance Model**

This model was pioneered by Davis (1989) and is also called the TAM. This model covers the adoption behavior of customers an assessment of which is usually made in order to determine a system to be used which will both be useful and convenient to the customers. Previous authors researched on the fundamental construct of TAMs validity in forecasting the acceptance of individual's concluded that TAMs

fundamental construct does not explain how user's acceptance is impacted upon by technology and other usability factors (Moon & Kim, 2015). Davis (1989) contends that expected usefulness refers to the belief by an individual that the technology or information system adopted will significantly improve job performance after its adoption. Perceived effortlessness of use indicates how easy it is for the individual to learn how to operate the new technology and information system. The model puts an emphasis on simplicity of use as a way to predict the usefulness of a system (Gefen, Karahanna & Straub, 2013).

Pikkarainen, Pikkarainen, Karjaluoto and Pahnla (2014) carried out a survey in Finland to establish the actual impact of perceived usefulness and concluded that it endeared use of inventive, autonomous, self-service and user friendly technologies to users through the banking system to provide financial services to clients in the twenty first century. Gerrard and Cunningham (2013) observed that the perceived usefulness hinged on the rendered banking services. These services range from paying utility bills, checking account balances, loan applications, money transfer abroad, and getting pertinent mutual funds information.

Evidence points at how importance the perceived usefulness of a technology is in the intent to adopt it. Tan and Teo (2013) posit that the perceived usefulness of a technology will influence its adaptation. In conclusion, the higher the perceived usefulness of using electronic banking practices, the greater the chances that electronic banking will be adopted for use (Potaloglu & Ekin, 2015). The major drivers of e-banking acceptance are viewed as the TAM variables.



### **2.3 Determinants of Cost Efficiency**

The following are the factors that are expected to have an effect on commercial bank's cost efficiency:

#### **2.3.1 Mobile Banking**

This involves the use of mobile devices to avail banking services such as account transactions for instance checking of account balances and transacting with stock market accounts. According to Porteous (2006), customers are able to order cheque book, access their account balance, receive debits and credit alerts, do funds transfer, pay bills from their phones, receive minimum balance alerts and check information including exchange rates and interest rates by use of mobile banking.

According to Porteous (2006) mobile banking has seen a tremendous growth in both financial service and global banking sectors. This is due to the benefits of mobile banking such as reaching out to a larger customer base and reduction of overall operational costs. The increased adoption of mobile banking has been accelerated by increased demand for convenience by account holders and increased mobile phones adoption. Mobile banking is highly beneficial to the customers since it saves on time and increase convenience while banks have benefited through elimination of barriers that deterred the access to financial services by the customers (Mburu 2013).

#### **2.3.2 Asset Quality**

Asset quality forecasts the degree of asset quality and among the dynamics which affects the health status of a bank. The value of assets controlled by a specific bank relies on the amount of asset quality, and the assets quality controlled through the bank also relies on liability to particular risks, tendencies on NPLs, and the cost-

effectiveness of the debtors to the bank (Athanasoglou et al, 2008). Preferably, this ratio ought to be at a minimum. If the lending books are vulnerable to risk in a smoothly operated bank, this would be reflected by advanced interest margins. On the other hand, if the ratio decreases it entails that the risk is not being appropriately recompensed by margins.

Impaired Loans or Loan Loss Reserves will be used as a measure of asset quality for banks. The ratio of loan loss reserve to that of NPLs will be utilized as proxy for assessing the asset value. The higher the ratio is, the more enhanced the bank becomes provided and thus the more contented it will tend to feel about the assets value. Measurement of charge-off in Net over net income prior the ratio of loan loss provision is against annual generation of income but coincides with charge-offs (Collins, 2010).

### **2.3.3 Bank Liquidity**

Liquidity is defined as the degree in which an entity is able to honor debt obligations falling due in the next twelve months through cash or cash equivalents for example assets that are short term can be quickly converted into cash. Liquidity results from the managers' ability to fulfill their commitments that fall due to creditors without having to liquidate financial assets (Adam & Buckle, 2003).

According to Liargovas and Skandalis (2008), liquid assets can be used by firms for purposes of financing their activities and investments in instances where the external finance is not forthcoming. Firms with higher liquidity are able to deal with unexpected or unforeseen contingencies as well as cope with its obligations that fall. Almajali et al., (2012) noted that firm's liquidity may have high impact on efficiency

of firms; therefore firms should aim at increasing their current assets while decreasing their current liabilities as per his recommendation. However, Jovanovic (1982) noted that an abundance of liquidity may at times result to more harm.

#### **2.3.4 Bank Size**

Bank size determines the extent to which a firm is affected by legal and financial factors. The size of the bank is also closely linked with the capital adequacy because large banks raise less expensive capital and thus generate huge profits. Bank size has a positive correlation with the return on assets indicating that large banks can achieve economies of scales that reduce operational cost and hence help banks to improve their financial performance (Amato & Burson, 2007). Magweva and Marime (2016) link bank size to capital ratios claiming that they are positively related to each other suggesting that as the size increases profitability rises.

According to Amato and Burson (2007), the size of an organization is primarily determined by the amount of assets it owns. An argument can be made that the larger the assets a firm owns, the more its ability to undertake a large number of projects with greater returns in comparison with small firms with a smaller amount of assets. Additionally, the bigger the firm, the larger the amount of collateral that can be pledged in a move to access credit facilities in comparison to their smaller competitors (Njoroge, 2014). Lee (2009) concluded that the amount of assets in control of a firm has an influence on the level of profitability of the said firm from one year to the next.

## **2.4 Empirical Review**

Local and international studies have been done to support the relationship between mobile banking and cost efficiency, but these studies have produced mixed results.

### **2.4.1 Global Studies**

Ching Chuan, Sim, Kam, and Tan (2011) examined the factors affecting the adoption of mobile banking in Malaysia using empirical analysis. The TAM was used to measure the level of acceptance of mobile banking in Malaysia. The study's objective was to investigate the association between constructs of perceived risks, perceived innovativeness, perceived usefulness, perceived ease of use, perceived relative advantages and social norms and towards behavioral intention in the adoption of mobile banking. The result of study's disclosed that perceived usefulness, relative advantages, perceived risks, personal innovativeness and perceived ease of use were the factors influencing mobile users' behavioral intention to adopt mobile banking services in Malaysia.

A study by Mohammad and Saad (2011) on the influence of electronic banking on the performance of Jordanian banks over the period (2000 to 2010) concluded that electronic banking negatively affects banks' performance which was akin to the findings of Delgado, Hernando and Nieto (2007) and Siam (2006). Electronic banking adoption impacts on a bank's risk profile. The risk management principles issued by Basel Committee in July 2003 for electronic banking recognize the related risk factors and the committee's aim was to promote and enhance safety of services provided by online banking while observing flexibility in line with emerging technologies as a result of the turbulent environment.

Tchouassi (2012) used empirical studies from selected Sub-Saharan Countries to establish whether mobile phones actually contribute in extending banking services to the unbanked. The aim of the study was to find how mobile phones could be used to the unbanked and poor segment of the population. The findings revealed that poor and vulnerable households in Sub-Saharan Africa nations often incur high financial transactions while undertaking basic financial transactions. Therefore, the use of mobile phone could improve the provision of financial services in this segment and that technological and economic innovation, regulatory and policy innovation was required to extend this services.

Kajewski (2014) studied innovations: benefits, challenges and recommendations for practice in Australia in the banking sector. Descriptive research design was adopted. Secondary data was obtained from risk manuals and financial reports of a sample of 38 commercial banks in Australia. The data was analyzed by use of correlation analysis, autocorrelation techniques and regressions analysis. The study discovered that throughout the years, banks had progressively invested in the various technology platforms in an effort to improve financial access to their clientele. The study also found that the number of transactions had gone up as a result of these innovations. He observed a positive significant effect of innovation on banks profitability in that it reduced the cost of doing business and delivered services that were more efficient to the customers.

Wadhe and Saluja (2015) explored the on how the profitability banks in India from the period 2006 to 2014 was affected by E-banking. A sample of 31 Indian commercial banks was used. The effect of E-banking services on the commercial

banks' profitability was tested using the multiple regression analysis. The findings depicted a positive association between e-banking and profitability in the private sector as well as in the public sector banks'. Base on this study it was pointed that an increase in the number of ATMs was necessary so as to realize increased profitability. However, a negligible association existed between the amount of branches and the banks' profitability.

#### **2.4.2 Local Studies**

Ocharo and Muturi (2016) study on how alternative banking channels like mobile banking, ATMs, internet and agency banking affects profitability of banks within the County of Kisii revealed a positive correlation between the performance of the banks and the use of alternative banking methods. 187 respondents were the total population of which 170 were employees and 17 were managers of the banks within the Kisii County.

Mwiti (2016) did an examination of the impact of alternative banking methods on the performance of Kenyan commercial banks financially. His study used five year (2011-2015) data for analysis. Regression analysis was employed to determine how alternative banking channels affect the financial performance of the banks. His study indicated that a strong positive relationship between alternative banking channels and financial performance of the banks existed. The study further showed that alternate banking channels affects financial performance of the banks both positively and the effect was statistically significant.

Kinyua (2018) sought to determine the effect of internet banking on efficiency of banks in Kenya. A population of the 42 banks operating in Kenya was used. Internet

banking in this study was the predictor variable given by the natural log of total value of transactions through internet banking. The response variable in the study was efficiency which was given by the ratio of total revenue to total assets. Secondary data was collected for a period of 5 years (January 2013 to December 2017) on an annual basis. The results showed that all variables were statistically significant in the study. Internet banking together with liquidity produced positive values while bank size produced a negative value for this study. The study found that capital adequacy is a non-statistically significant determinant of efficiency of commercial banks.

Muli (2018) studied how electronic banking affects efficiency of commercial banks in Kenya. He sampled all the 42 banks operating in Kenya. The predictor variable was selected as electronic banking as measured by value of transactions done by use of agency banking, internet banking, mobile banking and ATMs. Efficiency was selected as the response variable of the study. Secondary data for 5 years was collected beginning January 2013 up to December 2017. The results revealed that mobile banking, ATMs, capital adequacy, liquidity and bank size had both a positive and significant effect on this study. Internet banking and agency banking were found to be statistically insignificant determinants of commercial banks efficiency.

Chirah (2018) sought to determine the impact of alternative banking channels on commercial banks in Kenya operational efficiency. A population of all commercial banks operating in Kenya which are 42 was used. The independent variable for the study was alternative banking channels as measured by value of transactions carried out through internet banking, mobile banking, ATMs and agency banking. Operational efficiency was the response variable which was measured by the ratio of

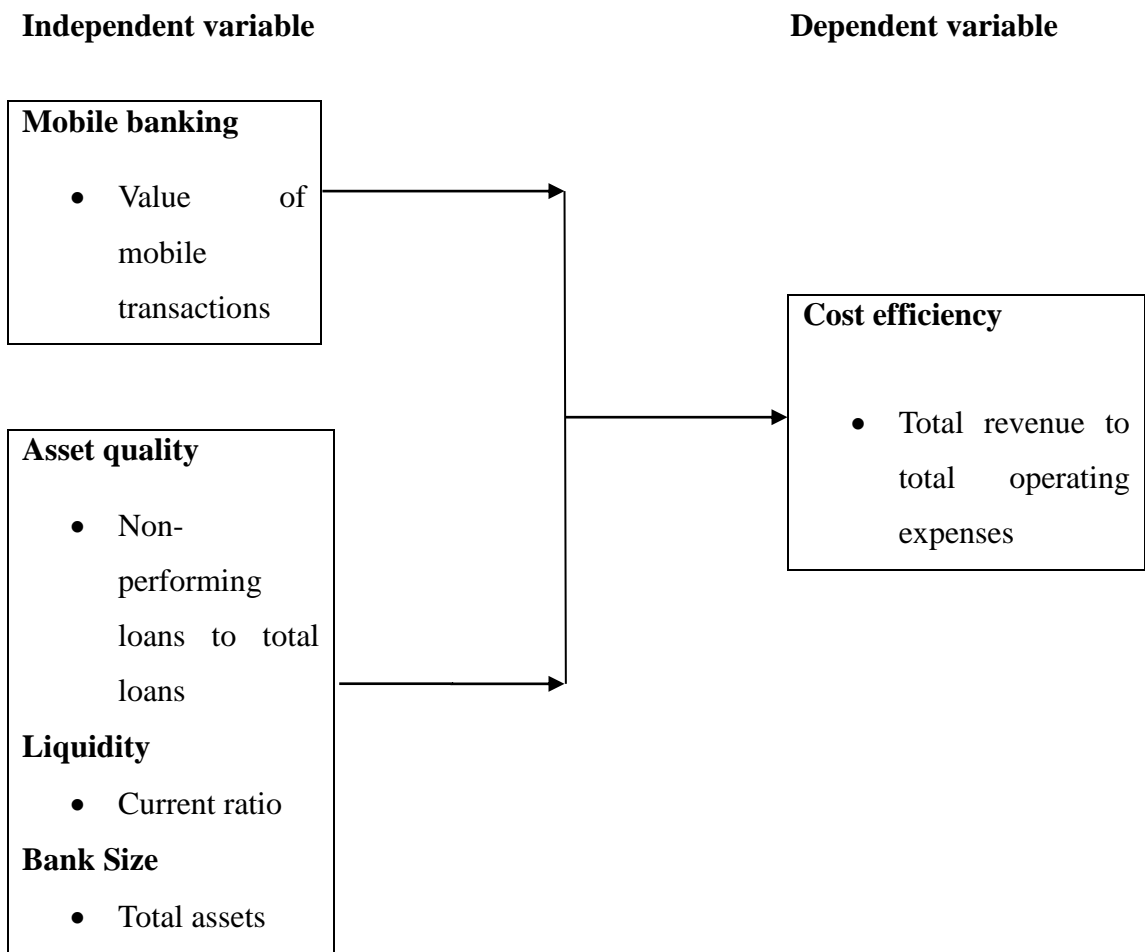
operating expenses to total revenue. Secondary data was for 5 years was collected for beginning in January 2013 up to December 2017 on an annual basis. The results revealed that liquidity had a positive and significant value in this study. The study revealed that ATMs, agency banking, mobile banking, internet banking, firm size and capital structure are statistically insignificant determinants of operational efficiency of commercial banks.

## **2.5 Conceptual Framework**

The model developed below portrays the expected association existing between the variables. The predictor variable was mobile banking given as natural logarithm of the value of mobile banking transactions per year. The control variables were asset quality as measured by the ratio of non-performing loans to total loans, liquidity as measured liquid assets divided by customer deposits and bank size given as the natural log of total assets. The dependent variable was cost efficiency measured by total revenue divided by total operating expenses.



**Figure 2.1: The Conceptual Model**



**Control Variables**

**Source: Researcher (2019)**

**2.6 Summary of the Literature Review**

A number of theoretical frameworks have explained the theoretically expected relationship between mobile banking and cost efficiency of banks. The theories covered in this review are; financial intermediation theory, technology acceptance model and diffusion of innovation theory. Some of the primary influencers of cost efficiency have also been explored in this chapter. A number of local and international

empirical studies have been carried out on mobile banking and cost efficiency of firms. The findings of these studies have also been explored in this section.

The lack of consensus among international and local studies on the impact of mobile banking on cost efficiency of commercial banks is an enough reason to conduct further studies. The reviewed studies in the Kenyan context have either failed to show how the Kenyan commercial bank's cost efficiency is affected by mobile banking or consider financial performance as the response variable. This research gap is what this study sought to fill.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

The chapter comprises of the research structure, the research population, the procedure of data gathering, test of assumptions under diagnostic tests and techniques of analyzing the collected study data.

### **3.2 Research Design**

The research utilized a descriptive cross-sectional research design in the determination of the association of mobile banking and cost efficiency of commercial banks. Descriptive design was utilized as the researcher is interested in finding out the state of affairs as they exist (Khan, 2008). This design is more appropriate since the researcher is familiar with the phenomenon under study but is more interested in finding out the nature of relationships between the study variables. In addition, a descriptive research aims at providing a valid and accurate representation of the study variables and this helps in responding to the research question (Cooper & Schindler, 2008).

### **3.3 Population**

This study's population was the 42 commercial banks that operated in Kenya as at 31<sup>st</sup> December 2018. Since the population is finite, a survey of the 42 banks was undertaken for the study (see appendix I).

### **3.4 Data Collection**

The study relied on secondary data from published annual financial reports published by banks operating in Kenya between January 2014 and December 2018 and captured in a data collection sheet. The reports were obtained from the CBK web page and banks annual reports. The end result was annual information concerning the predictor variables and the response variable for the 42 commercial banks in Kenya.

### **3.5 Diagnostic Tests**

The study undertook several diagnostics test to assess the applicability of the research structure.

#### **3.5.1 Normality Test**

These are support graphical evaluation of normality (Elliott & Woodward, 2007). Normality tests compare the results in a subject under study to a standardized distribution of results having similar results; the null hypothesis states “the sample distribution is normal.” If the test is significant, the distribution is non-normal. Samples usually pass normality tests; but for big samples, notable outcomes would be obtained even if there is a small change from normality, even though a small change won't have an impact on the outcomes of a parametric test (Oztuna et al. 2007). The Shapiro-Wilk test is built on the correlations between information and the regular outcomes; the Shapiro-Wilk test is considered by pundits to be the best option for investigating the normality of data (Thode, 2002).

#### **3.5.2 Multicollinearity Test**

To ensure the data collected is free from bias and one variable data is not related to another variable data, the study conducted a multicollinearity test. It occurs where the

linear correlation among independent variants is close to precise or precise. The variance inflation factor (VIF) will be applied to test Multicollinearity. When the values of VIF are between 1 and 10, then there is no Multicollinearity, when the VIF is less than 1 or greater than 10, there is presence of Multicollinearity. When the test fails the researcher should standardize the continuous variables by choosing a standardization method on the regression dialog box e.g. one may choose a variable centering approach (Burns & Burns, 2008).

### **3.5.3 Heteroskedasticity**

Heteroscedasticity is considered to be a presumption of Classical Linear Regression Model (CLRM) which necessitates examination and accounting for in data, where it occurs. The Classical Linear Regression Model adopts that error homoscedastic, i.e. it is constant. In case the error variance isn't constant, then the data has heteroskedasticity. If a regression model is run without considering heteroskedasticity, impartial parameter approximations will be realized, but with false standard errors. The heteroskedasticity test assessed if the error terms are correlated across observation in the time series data. From a regression model, the error terms must have a constant variance called homoskedastic. Therefore, to ensure that the residuals meet these criteria, the Breusch-Pagan test was employed for heteroskedasticity whereby the alternative hypothesis for this test is that residuals are homoskedastic (Gujarati, 2004).

### **3.5.4 Autocorrelation**

It refers to measurement of sameness between specific time and value of the same time series over consecutive periodic periods. It was examined by the Durbin-Watson

test. This test provides results ranging from 0 to 4 where a test statistic of 2 implies no autocorrelation, less than 2, implies there is positive autocorrelation, and more than 2, implies there is negative autocorrelation (Khan, 2008).

### **3.6 Data Analysis**

The SPSS software version 21 was used in the analysis of the data. The researcher quantitatively presented the findings using graphs and tables. Descriptive statistics were employed for summarizing and explaining the study variables that were observed in banks. The results were presented by use of percentages, frequencies, measures of central tendencies and dispersion displayed in tables. Inferential statistics included Pearson correlation, ANOVA, multiple regressions and coefficient of determination.

#### **3.6.1 Analytical Model**

The regression model below was used:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon.$$

Where: Y = Cost efficiency of commercial banks measured as ratio of total revenue to total operating expenses on an annual basis

$\alpha$  = y regression intercept.

$\beta_1, \beta_2, \beta_3, \beta_4$  = regression slope

$X_1$  = Mobile banking measured as natural logarithm of the value of mobile banking transactions per year

$X_2$  = Asset quality measured as the ratio of non-performing loans to total gross loans and advances per year

$X_3$  = Bank liquidity measured as ratio of liquid assets to customer deposits on

an annual basis

$X_4$ = Bank size measured as natural logarithm of total assets on an annual basis

$\varepsilon$  =error term

### **3.6.2 Tests of Significance**

Parametric tests were carried out by the researcher to establish the statistical significance of both the overall model and individual parameters. The F-test was used in the determination of the significance of the overall model and it was obtained from Analysis of Variance (ANOVA) while a t-test was used to establish statistical significance of individual variables.

## **CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION**

### **4.1 Introduction**

This section details the analysis, findings and elucidation of the secondary data obtained from the CBK and individual banks websites. The aim of the study was establishing the effect of mobile banking on cost efficiency of commercial banks in Kenya. The independent variables for the study were mobile banking, asset quality, liquidity and bank size while the dependent variable was mobile banking. Regression analysis was adopted to determine the effect between the variables of study in relation to the study's objectives.

### **4.2 Descriptive Analysis**

The statistics produces a representation of the mean, minimum and maximum values of variables presented including the standard deviations. Table 4.1 below displays the qualities of each variable. An output of each variable was extracted using SPSS software for a five-year time frame (2014 to 2018) on an annual basis.

The study found out that cost efficiency recorded an average of 2.0813 over the study period. Over the same period, mobile banking recorded an average of 4.9402 while asset quality recorded an average of 0.1097. Further, liquidity and bank size recorded an average of 0.8247 and 17.64 respectively. The standard deviation indicated that cost efficiency, mobile banking, asset quality, liquidity and bank size varied over the study period. The greatest variation was recorded by mobile banking (3.3804) followed by cost efficiency (2.4692).



**Table 4.1: Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Cost efficiency	190	1.1071	34.3171	2.081333	2.4691973
Mobile banking	190	.4188	28.8039	4.940231	3.3803867
Asset quality	190	.00000	.71960	.1096858	.10960029
Liquidity	190	.0450	1.7430	.824701	.2488595
Bank size	190	15	20	17.64	1.376
Valid N (listwise)	190				

**Source: Research Findings (2019)**

### 4.3 Diagnostic Tests

The data collected was subjected to diagnostic tests. The study presumed a significance level of 5% or 95% confidence interval so as to make variable deductions on the data adopted. Diagnostic tests were useful for ascertaining the falsity or truth of the data. In this case, the tests conducted were normality test, Multicollinearity test, heteroskedasticity test and autocorrelation tests.

#### 4.3.1 Normality Test

Shapiro-wilk test was utilized for normality testing. The level of significance in the study was 5%. The null hypothesis is that the data is distributed normally. Since the p value of all the variables is greater than the  $\alpha$  (0.05), then the null hypothesis is not rejected. Hence the data series of all the variables is normally distributed.

**Table 4.2: Normality Test**

	Statistic	Shapiro-Wilk	
		Df	Sig.
Cost efficiency	.894	190	.790
Mobile banking	.892	190	.784
Liquidity	.893	190	.787
Asset quality	.896	190	.792

**Source: Research Findings (2019)**

### 4.3.2 Multicollinearity Test

Multicollinearity can be defined as a statistical state where more than one predictor variables are highly correlated in a multiple regression model. It is an unwanted situation for independent variables to have a strong correlation. A combination of variables is said to exhibit high Multicollinearity in case there is one or more exact linear correlation among the study variables.

**Table 4.3: Multicollinearity Test**

<b>Variable</b>	<b>Collinearity Statistics</b>
	<b>VIF</b>
Mobile banking	2.659
Asset quality	2.513
Liquidity	2.577
Bank size	2.717

**Source: Research Findings (2019)**

VIF value of the variables was utilized where the values below 10 imply no Multicollinearity. From the results, all the variables had a VIF values <10 as illustrated in table 4.2 suggesting that no Multicollinearity exist.

### 4.3.3 Heteroskedasticity Test

The researcher checked for heteroskedasticity by use of Likelihood Ratio (LR) as indicated in the Table. This test used the alternative hypothesis that the error was homoscedastic. A chi-square value of 33.48 was produced by the likelihood-ratio test with a 0.0000 p-value. The chi-square esteem was significant at 1 percent level, in this manner the invalid speculation of consistent fluctuation was rejected meaning the nearness of heteroskedasticity in the examination information as suggested by Poi and

Wiggins (2001). To deal with this issue the examination utilized the FGLS estimation method.

**Table 4.4: Heteroskedasticity Test**

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Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of cost efficiency

chi2(1) = 33.48

Prob > chi2 = 0.0000

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**Source: Research Findings (2019)**

#### 4.3.4 Autocorrelation Test

To test for autocorrelation, Durbin-Watson statistic was applied which gave an output of 2.049 as displayed in Table 4.4. The Durbin-Watson statistic ranges from point 0 and point 4. If there exist no correlation between variables a value of 2 is shown. If the values fall under point 0 up to a point less than 2, this is an indication of an autocorrelation and on the contrast a negative autocorrelation exist if the value falls under point more than 2 up to 4. As a common rule in statistics, values falling under the range 1.5 to 2.5 are considered relatively normal whereas values that fall out of the range raise a concern. Field (2009) however, opines that values above 3 and less than 1 are a sure reason for concern. Therefore, the data used in this panel is not serially auto correlated since it meets this threshold.

**Table 4.5: Autocorrelation Test**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.587 <sup>a</sup>	.345	.331	.1023951	2.049

a. Predictors: (Constant), Bank size, Liquidity, Mobile banking, Asset quality  
b. Dependent Variable: Cost efficiency

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**Source: Research Findings (2019)**

#### **4.4 Correlation Analysis**

Correlation analysis establishes whether there exists an association among two variables. The association falls between a perfect positive and a strong negative correlation. This study utilized Pearson correlation to analyze the level of association between cost efficiency and its determinants. The study employed a confidence interval of 95%, as it is the most utilized in social sciences. A two tailed test was utilized. Table 4.5 shows the correlation analysis outcome.

Existence of a positive and statistically substantial correlation ( $r = .195$ ,  $p = .007$ ) between mobile banking and cost efficiency was revealed. Further results discovered a positive and significant correlation between liquidity and commercial banks' cost efficiency as demonstrated by ( $r = .470$ ,  $p = .007$ ) existed. Asset quality was also noted to have a negative and significant association with cost efficiency as evidenced by ( $r = -.143$ ,  $p = .048$ ). Bank size exhibited a positive relationship with cost efficiency but the association was not statistically significant as evidenced by a p value above 0.05. The study further found that although there was an association between the independent variables, it was not strong enough to result to Multicollinearity. In statistics, multicollinearity is a situation where there is existence of a perfect relationship between the predictor variables. Existence of an exact or a perfect among the predictor variables makes it challenging to derive dependable estimations of individual coefficients. Thus, it leads to improper conclusions of the relationships among the independent and the dependent variables.

**Table 4.6: Correlation Analysis**

		Cost efficiency	Mobile banking	Asset quality	Liquidity	Bank size
Cost efficiency	Pearson Correlation	1				
	Sig. (2-tailed)					
Mobile banking	Pearson Correlation	.195**	1			
	Sig. (2-tailed)	.007				
Asset quality	Pearson Correlation	-.143*	-.280**	1		
	Sig. (2-tailed)	.048	.000			
Liquidity	Pearson Correlation	.470**	.187**	-.059	1	
	Sig. (2-tailed)	.000	.010	.422		
Bank size	Pearson Correlation	.037	.084	-.257**	.066	1
	Sig. (2-tailed)	.613	.247	.000	.366	

\*\* . Correlation is significant at the 0.01 level (2-tailed).  
\* . Correlation is significant at the 0.05 level (2-tailed).  
c. Listwise N=190

**Source: Research Findings (2019)**

#### 4.5 Regression Analysis

At significance level of 5% a regression analysis was accomplished between cost efficiency and the four predictor variables selected for this study. The F critical value was compared against the F calculated.

**Table 4.7: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.587 <sup>a</sup>	.345	.331	.1023951	2.049

a. Predictors: (Constant), Bank size, Liquidity, Mobile banking, Asset quality  
b. Dependent Variable: Cost efficiency

**Source: Research Findings (2019)**

From table 4.7, the R-square value was 0.345, implying that 34.5 % of the deviations in cost efficiency by commercial banks is caused by changes in mobile banking, bank size, asset quality and liquidity. Other factors not incorporated in the model are

attributed 65.5% of the changes in cost efficiency. The correlation coefficient (R) value of 0.587 shows there exists a strong relationship between the independent variables included in the study and cost efficiency.

Table 4.8 provides the outcomes of the ANOVA; the essence of F-test was to establish how significant model. A critical value of 2.46 was obtained from the F-Test tables. The F statistic indicated in the study findings is more than the critical value, thus the whole model is significant to predict cost efficiency.

**Table 4.8: ANOVA**

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1.022	4	.256	24.371	.000 <sup>b</sup>
Residual	1.940	185	.010		
Total	2.962	189			

a. Dependent Variable: Cost efficiency

b. Predictors: (Constant), Bank size, Liquidity, Mobile banking, Asset quality

**Source: Research Findings (2019)**

So as to ascertain the significance of each variable individually variable in this research as a predictor of the cost efficiency by banks it was important for t-test to be employed. P-value was utilized to indicate how significant the relationship between the response and the predictor variables was. Confidence level at 95% and value of p below 0.05 was understood as an index of statistical significance of the concepts. Therefore, a p-value more than 0.05 depicts an insignificant variable. The outcomes are demonstrated in table 4.9.

**Table 4.9: Model Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	.327	.107		3.066	.002
Mobile banking	.013	.002	.354	5.555	.000
Asset quality	-.246	.074	-.216	-3.327	.001
Liquidity	.263	.031	.523	8.617	.000
Bank size	.001	.006	.014	.224	.823

a. Dependent Variable: Cost efficiency

**Source: Research Findings (2019)**

The coefficients are used as an indicator of the magnitude and direction of the relation between the predictors and the response variable. The T values were applied to establish the significance of the relationship of the predictor variable to the response variable. The values obtained are contrasted to the critical values. A confidence interval of 95% and a two tailed T test critical value of  $\pm 2.04523$  were obtained from the T test tables. A T test value that lies out of this range is significant.

The results revealed that mobile banking and liquidity have positive and significant influence on cost efficiency. Implication of this is that a unit increment in either mobile banking or liquidity will result to an increase in cost efficiency by 0.013 and 0.263 respectively. Asset quality exhibited a negative and statistically significant influence on cost efficiency implying that an increase in asset quality by 1 unit would reduce cost efficiency by -2.46. The findings further revealed that although bank size had a positive influence on cost efficiency, the influence was not statistically significant. The constant coefficient 0.327 implies that when the four selected independent variable have a zero value, cost efficiency by banks would be equal to the figure.

The regression equation below was thus estimated:

$$Y_i = 0.327 + 0.013X_1 - 0.246X_2 + 0.263X_3$$

Where;

$Y_i$  = Cost efficiency

$X_1$  = Mobile banking

$X_2$  = Asset quality

$X_3$  = Liquidity

#### **4.6 Discussion of Research Findings**

The researcher was seeking to assess the effect of mobile banking on cost efficiency of commercial banks in Kenya. Mobile banking, asset quality, liquidity and bank size were the predictor variables in this study while cost efficiency measured by the ratio of total revenue to total operating expenses in a given year was the dependent variable. The adequacy of the overall model in predicting cost efficiency was examined. The influence of each predictor variable on the dependent variable was also examined with respect to strength and direction.

From the results of Pearson correlation, a positive and statistically notable correlation between mobile banking and cost efficiency was observed. Further a positive and significant correlation between liquidity and commercial banks' cost efficiency existed. Asset quality was noted to have a negative and significant association with cost efficiency. Only bank size was found to have a positive but insignificant link with cost efficiency.

The independent variables from the model summary revealed that: mobile banking,



asset quality, liquidity and bank size explains 34.5% of variations in the response variable as shown by R square which derives an implication that other factors not considered in the model explain the 65.5% of variations in cost efficiency. The model was found fit at 95% confidence level because the F-value is 24.371. This signifies that the model adopted is appropriate for predicting and explaining how the independent variables affect commercial banks' cost efficiency. This implies that mobile banking, bank size, asset quality and liquidity are good predictors of cost efficiency.

This study agrees with Muli (2018) who studied how electronic banking affects efficiency of commercial banks in Kenya. He sampled all the 42 banks operating in Kenya. The predictor variable was selected as electronic banking as measured by value of transactions done by use of agency banking, internet banking, mobile banking and ATMs. Efficiency was selected as the response variable of the study. Secondary data for 5 years was collected beginning January 2013 up to December 2017. The results revealed that mobile banking, ATMs, capital adequacy, liquidity and bank size had both a positive and significant effect on this study. Internet banking and agency banking were found to be statistically insignificant determinants of commercial banks efficiency.

The study findings differ with that conducted by Chirah (2018) who sought to determine the impact of alternative banking channels on commercial banks in Kenya operational efficiency. A population of all commercial banks operating in Kenya which are 42 was used. The independent variable for the study was alternative banking channels as measured by value of transactions carried out through internet

banking, mobile banking, ATMs and agency banking. Operational efficiency was the response variable which was measured by the ratio of operating expenses to total revenue. Secondary data was for 5 years was collected for beginning in January 2013 up to December 2017 on an annual basis. The results revealed that liquidity had a positive and significant value in this study. The study revealed that ATMs, agency banking, mobile banking, internet banking, firm size and capital structure are statistically insignificant determinants of operational efficiency of commercial banks.

## **CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Introduction**

The main goal of the study was establishing the influence of mobile banking on cost efficiency of commercial banks in Kenya. This chapter gives an overview of the results from the previous chapter, conclusion, limitations encountered during the study. Moreover, it recommends policies that policy makers can use. Additionally, the chapter gives recommendations for future researchers.

### **5.2 Summary of Findings**

The aim of the research was to ascertain the effect of mobile banking on cost efficiency of commercial banks in Kenya. To conduct the study, mobile banking was given as the natural logarithm of total value of mobile banking transactions in an year, asset quality given by ratio of non-performing loans to total loans in an year, liquidity as measured liquid assets divided by customer deposits and bank size given as the natural log of total assets. Cost efficiency was the response variable that formed the scope of the study and it was be given by the ratio of total revenue to total operating expenses. The researcher reviewed available theoretical foundations and empirical reviews to get an understanding on the generally accepted relationship among the selected dependent and independent variables. From this review, a conceptual framework was developed that hypothesized the expected association between the study variables.

Descriptive research design was employed. All the 42 commercial banks as at December 2018-year end comprised the population of this study and from this, data was obtained from 38 banks giving a response rate of 90.48%. Data secondary in nature was acquired from CBK and individual banks financial reports for a time frame 5 years spanning 2014 to 2018 was used. The researcher carried out descriptive, correlation analysis as well as regression analysis. So as to confirm that the data is fit for analysis the researcher transformed the data and conducted diagnostic tests to make sure that the data has the required characteristics before conducting inferential statistics. Regression analysis was applied in testing the strength of the association between the study variables and to test both the significance of the overall model and individual parameters. SPSS software version 22 was used to carry out the analysis.

Pearson correlation showed that a positive and statistically notable correlation between mobile banking and cost efficiency exists. Further a positive and significant correlation between liquidity and commercial banks' cost efficiency existed. Asset quality was noted to have a negative and significant association with cost efficiency. Only bank size was found to have a positive but insignificant link with cost efficiency.

The coefficient of determination also called R square shows the disparities in the response variable triggered by variations from the predictor variable. From the results, R square was found to be 0.345, a revelation that 34.5% of the changes in cost efficiency stems from variations in mobile banking, bank size, asset quality and liquidity. Alternative factors beyond those in the model justify for 65.5% of these changes in cost efficiency. The findings showed a strong correlation between the

chosen variables and the FP of banks ( $R=0.587$ ). Results from the ANOVA test showed that the F statistic was at significance level of 5% and a  $p=0.000$  rendering the model appropriate for providing an explanation of the relation between the variables studied.

The study further found that a unit increment in either mobile banking liquidity or will result to an increase in cost efficiency by 0.013 and 0.263 respectively. Asset quality exhibited a negative and statistically significant influence on cost efficiency implying that an increase in asset quality by 1 unit would reduce cost efficiency by -.246. The findings further revealed that although bank size had a positive influence on cost efficiency, the influence was not statistically significant. The constant coefficient 0.327 implies that when the four selected independent variable have a zero value, cost efficiency by banks would be equal to the figure.

### **5.3 Conclusion**

The findings of this study show that the cost efficiency by Kenyan banks is notably impacted by mobile banking and liquidity. This research shows that an increment in a unit in these variables significantly increases cost efficiency among commercial banks in Kenya. The study further revealed that asset quality has a significant negative effect on cost efficiency among banks. This study therefore concludes that banks with high asset quality on average are more cost efficient compared to banks with less asset quality. The study also showed that bank size was statistically insignificant in determining cost efficiency and hence the study concluded that bank size does not have a profound effect on cost efficiency.

The conclusion of this study is that the independent variables selected for this study (mobile banking, bank size, asset quality and liquidity) to a larger extent have a notable influence on cost efficiency among banks in Kenya. The conclusion is that these variables have a notable impact on the cost efficiency among banks given the p value in anova summary. The finding that 34.5% of the variations in the response variable are from the four factors listed implies that the 65.5% variations result from other factors outside the model.

This study agrees with Muli (2018) who studied how electronic banking affects efficiency of commercial banks in Kenya. He sampled all the 42 banks operating in Kenya. The predictor variable was selected as electronic banking as measured by value of transactions done by use of agency banking, internet banking, mobile banking and ATMs. Efficiency was selected as the response variable of the study. Secondary data for 5 years was collected beginning January 2013 up to December 2017. The results revealed that mobile banking, ATMs, capital adequacy, liquidity and bank size had both a positive and significant effect on this study. Internet banking and agency banking were found to be statistically insignificant determinants of commercial banks efficiency.

The study findings differ with that conducted by Chirah (2018) who sought to determine the impact of alternative banking channels on commercial banks in Kenya operational efficiency. A population of all commercial banks operating in Kenya which are 42 was used. The independent variable for the study was alternative banking channels as measured by value of transactions carried out through internet banking, mobile banking, ATMs and agency banking. Operational efficiency was the

response variable which was measured by the ratio of operating expenses to total revenue. Secondary data was for 5 years was collected for beginning in January 2013 up to December 2017 on an annual basis. The results revealed that liquidity had a positive and significant value in this study. The study revealed that ATMs, agency banking, mobile banking, internet banking, firm size and capital structure are statistically insignificant determinants of operational efficiency of commercial banks.

#### **5.4 Recommendations of the Study**

Leveraging on the study findings, below recommendations has been drawn. The study showed that mobile banking has a positive influence on cost efficiency. This implies that a bank that has embraced mobile banking more is likely to achieve more efficiency in managing cost compared to a bank that has embraced mobile banking to a less extent. A recommendation is that banks' management and directors should focus on increasing their mobile banking channels by formulating measures and policies centered on reaching more customers as this has an effect on their cost efficiency.

The study recognized that there exists a positive and significant influence of liquidity on cost efficiency among banks. Thus, the study findings were that an increase in a bank's liquidity will significantly influence cost efficiency. This study therefore recommends that a comprehensive assessment of banks' immediate liquidity position should be undertaken to ensure the banks are operating at sufficient levels of liquidity that will lead to improved cost efficiency among commercial banks.

The study showed a negative but significant influence of asset quality on cost efficiency among banks. Thus, the findings were that asset quality does notably

influence cost efficiency. It is recommended that policy makers should prioritize asset quality when crafting policies on cost efficiency. It can also be recommended to financial institutions, and their boards that asset quality should be considered when carrying out strategic management practices to boost cost efficiency. Thus, it is necessary to adopt sufficient measures by managers of these banks to raise their efficiency by reducing the level of NPLs in their books. Commercial banks in Kenya should work on increasing their asset quality by undertaking measures such as stringent vetting of customers and other controls.

### **5.5 Limitations of the Study**

The study was confronted with limitations including; the data used was secondary in nature and the researcher is not aware of its authenticity and reliability based on its collection and storage and alterations that might have been done on it.

The study adopted the analytical approach which is highly scientific. The research also disregarded qualitative information which could explain other factors that influence cost efficiency among commercial banks. The study should have rather considered utilizing focus group discussions, open ended questionnaires or interviews so as to come up with more concrete results.

The research concentrated on 5 years (2014 to 2018). It is not certain whether the findings would hold for a longer time frame. It is also unclear as to whether similar outcomes would be obtained beyond 2018. The study should have been executed over a longer time frame in order to incorporate major forces such as booms and recession.



## **5.6 Suggestions for Further Research**

A suggestion is given that more research ought to include a qualitative analysis on determinants of cost efficiency among commercial banks in Kenya. That study would deal with interviewing of vital respondents in the banks and this would reveal concealed insights into the fine detailed relationship between cost efficiency and its determinants.

The study did not exhaust all the independent variables influencing cost efficiency by Kenyan commercial banks and a recommendation is given that more studies be carried out to constitute other variables for instance capital adequacy, ownership structures, management efficiency, corporate governance, age of the bank among others. Determining the impact of each variable on cost efficiency shall enable the policy makers to understand the tools that can be used to control operating expenses.

The research only focused on the commercial banks. The study's recommendations are that further studies be carried out on other financial institutions in Kenya. Finally, as a result of regression models' limitations, other models including the VECM model may be applied in explanation of the various relationships among variables.

## REFERENCES

- Abernathy, W.J., & Utterback, J.M. (2015), *Innovation and the evolution of technology in the Firm*, Harvard University Press, Cambridge, MA.
- Adams, M. & Buckle, M. (2003). The determinants of corporate financial Performance in the Bermuda Insurance Market. *Applied Financial Economics*, 13(2), 133-143
- Adembesa, J.L.M. (2014). *Perceived effects of mergers and acquisitions on employee productivity in commercial banks in Kenya*. Unpublished MBA Project, University of Nairobi.
- Agboola, A. (2006). Information and communication technology (ICT) in banking operations in Nigeria: An evaluation of recent experiences. *Journal of Business and Economics*, 2 (4), 43-62.
- Allen, F., & Gale, D. (1994). *Financial innovation and risk sharing*. MIT press.
- Allen, F., & Santomero, A.M. (2001). What do financial intermediaries do? *Journal of Banking & Finance*, 25, 271–294.
- Almajali, Y.A., Alamro, S.H., & Al-Soub, Y.Z (2012). Factors affecting financial performance of Jordanian insurance companies listed at Amman stock exchange. *Journal of Management Research*, 4(2), 91-101
- Amato, L. & Burson, T. (2007). The Effects of Firm Size on Profit Rates in the Financial Service, *Journal of Economic and Economic Research*, 8(1), 61- 81
- Athanasoglou, P., Brissimis, S., & Delis, M. (2005). Bank-Specific, Industry-Specific and Macroeconomics Determents of Bank Profitability, *Bank of Greece*, No. 25
- Barney, F. (2001). *Managing technological innovation: competitive advantage from change*. Hoboken, N.J: Wiley.

- Bouba, I. (2011). *Financial Performance Measurement of Manufacturing Small and Medium Enterprises in Pretoria: A Multiple Exploratory Case Study*. Unpublished Project. University Of South Africa
- Burns, N. & Burns, S. (2008). *The Practice of Nursing Research: Conduct, Critique and Utilization: 5<sup>th</sup> Edition*: St Louis, Elsevier Saunders
- Calantone, R.J., Vickery, S.K. & Droge, C. (1995). Business Performance and Strategic New Product Development Activities: An Empirical Investigation. *Journal of Product Innovation Management*, 12(2), 214-23.
- Central Bank of Kenya (2016). *Annual Reports*, Central Bank of Kenya, Nairobi.
- Central Bank of Kenya (2016). *Bank supervision annual reports*. CBK. Nairobi.
- Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the Efficiency of Decision Making Units, *European Journal of Operational Research*, 2, 429-444.
- Chebii, M. (2013). Kenya Commercial Bank and SME banking alternative channels. Retrieved from; <http://smefinanceforum.org/post/kenya-commercial-bank-and-SME-banking-alternative-channels-by-milkah-chebii-from-kcb>.
- Ching, M. C. Chuan, A. T., Sim, J. J. Kam, H. & Tan, B. (2011) Factors Affecting Malaysian Mobile Banking Adoption: An Empirical Analysis, *International Journal of Network and Mobile Technologies*, 2(3), 12-19
- Christopher, G. C., Mike, L. Visit & Amy, W. A (2005). Logit Analysis of Electronic Banking in New Zealand. *International Journal of Bank Market*, 24, 360- 383
- Crook, H. (2008). *Open Services Innovation*. London: John Wiley & Sons
- Currie, G.H. (2009). Innovation by design: What it takes to keep your company on the cutting edge. *AMACOM American management association*, New York, NY
- Dabholkar, P.A. (2016). *Technology in service delivery: implications for self-service and service esupport*, Handbook of Service Marketing and Management, Beverly Hills, CA: Sage.

- Darrab, I. A., & Khan, M. R. R. (2010). Development of analytical relation between maintenance, quality and productivity. *Journal of Quality Maintenance*, 16(4), 341-353.
- Davila, T. (2014). *The innovation strategy big companies should pursue*. Harvard Business School Publishing
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–339.
- Davis, J., Toxall, G. R., & Pallister, J. (2002). Beyond the intention-behavior mythology: An integrated model of recycling. *Marketing Theory*, 2 (1), 29-113.
- Dewatripont, D., Rochet, C., & Tirole, W. (2010). Financial intermediation and delegated monitoring. *Review of Economic Studies*, 51, 393-414
- Dishaw, M. T. & Strong, D. M. (1999). Extending the technology acceptance model with task-technology fit constructs, *Information & Management*, 36(1), 9-21.
- Donner, J. & Tellez, A. C. (2008). Mobile banking and economic development: Linking adoption, impact, and use, *Asian Journal of Communication*, 18(4): 318-325
- Drucker, P. (2001). Innovation and entrepreneurship. Butterworth-Heinemann, Oxford economy, *MIT Sloan Management Review*, spring, 21 (4), 34-59
- Essinger, J. (1999). The Virtual Banking Revolution: The Customer, the Bank and the Future. 1<sup>st</sup> ed., *International Thomson Business Press, London, UK*
- Ezeoha, E. E. (2005). Regulating Internet Banking in Nigeria: Problems and Challenges. *Journal of Internet Banking and Commerce*, 11(1), 23-54.
- Fishbein, M & Ajzen, I. (2010). *Predicting and changing behavior. An introduction to theory and research*. Reading, MA: Addison-Wesley

- Fisher, R.F. (1998). The elastic constants of the human lens, *Journal of Physiology*, 212 (2), 147-180
- Flannery, M., & Protopapadakis, W. (2002). Macroeconomic Factors that Influence Aggregate Stock Returns. *The Review of Financial Studies*, 7(4)751-782.
- Francesca, A., & Claeys, P. (2010). Innovation and performance of European banks adopting Internet. University of Milan and Cass Business School, City University London and University of Barcelona Centre for Banking Research, Cass Business School, City University London *Working Paper Series*, WP 04/10
- Furst, K., Lang, W. & Nolle, D. (2012). Internet banking, *Journal of Financial Services Research*, 22(2), 95-117.
- Gerstenfield, A. & Wortzel, L. (2007). Strategies for innovation in developing countries, *Sloan Management Review*, 2(1) 57-68
- Goh, A. (2002). Industrial Policy Focus of South East Asian Nations: Technology Development or Innovation? *Journal for Institutional Innovation, Development and Transition*, 6(1), 89-91
- Han, J. K., Kim, N. & Srivastava, R. K. (1998). Market Orientation and Organizational Performance: Is Innovation a Missing Link? *Journal of Marketing*, 62 (4), 30-45.
- Hans, P.P. & Kamath, S. (2013). *What the future holds for branch banking in India*. Living media India.
- Howcroft, J.B. (1993). Branch Networks and Alternative Distribution Channels: Threats and Opportunities. *International Journal of Bank Marketing*, 11(6), 26 – 31.
- Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrics*, 50, 649-670

- Kajirwa, H. I. (2015). Effects of Debt on Firm Performance: A Survey of Commercial Banks Listed on Nairobi Securities Exchange. *Global Journal of Advanced Research*, 2(6), 1025-1029
- Kalela, M. (2017). *Uptake of alternative banking channels and operational performance of commercial banks in Kenya*. An unpublished MBA Project, University of Nairobi.
- Kalluru, S. & Bhat, K. (2009). Determinants of Cost Efficiency of Commercial banks in India. *ICFAI Journal of Bank Management*, 8(2), 32-50.
- Kambua, B.D. (2015). *The effect of agency banking on financial performance of commercial banks in Kenya*. An unpublished MBA Project, University of Nairobi.
- Kantor, P. (2001). *Innovation and Business Performance*. Chicago: Chicago International Publishers.
- Kemp, R. (2003). *Innovativeness and Firm Performance*. Netherlands: Netherlands Press.
- Khan, J. A. (2008). *Research Methodology*. New Delhi. APH Publishing Corporation
- Kimani, N. (2015). *The effect of adoption of mobile banking systems on operational efficiency of commercial banks in Kenya*. Unpublished MBA project. Nairobi: University of Nairobi.
- Kimball, R., & Gregor, W. (1995). How distribution is transforming retail banking: Changes leading banks are making. *Journal of Retail Banking Services*, 17 (3), 1–9.
- Kirimi, S. G. (2011). *The Extent of Implementation of Agency Banking Among Commercial Banks in Kenya*. MBA Project, University of Nairobi.
- Kithuka, B. K. (2012). *Factors influencing growth of agency banking in Kenya: the case of Equity Bank, Kwale County, Kenya*. Unpublished MA Thesis, University of Nairobi.

- Kohali, A. & Sheleg, A. (2011). Alternative Banking Channels. *Tefen Tribune, Spring Issue, 2011*
- Kombe, S.K. & Wafula, M.K., (2015). Effects of Internet Banking on the Financial Performance of Commercial Banks in Kenya. *International Journal of Scientific and Research Publications, 5(5), 64-75*
- Kumar, H. A. (2006). On the relationship between innovation and performance: A sensitivity analysis. *Economics of Innovation and New Technology, 15(4-5), 317-344*
- Kumbhar, V.M. (2011). Alternative Banking Channels and Customers' Satisfaction: An Empirical Study of Public and Private Sector Banks. *International Journal of Business and Management Tomorrow, 1(1), 291-307*
- Kwon, A. & Song, I. (2011). Capital Structure and Firm Performance: Evidence from Iranian Companies. *International Research Journal of Finance and Economics, 70, 20-29*
- Lee, J. (2009). Does The Size Matter in Firm Performance? Evidence from US Public Firms, *Internal Journal of the Economic of Business, 16(2), 199- 203*
- Liargovas, P. & Skandalis K. (2008). *Factors affecting firm's financial performance. The case of Greece, Athens. University of Peloponnese Press.*
- Loof, H., & Heshmati, A. (2013). On the relationship between innovation and performance: A sensitivity analysis. *Economics of Innovation and New Technology, 15(4-5), 317-344*
- Magweva, R., & Marime, N. (2016). Bank specific factors and bank performance in the multi-currency era in Zimbabwe. *African Journal of Business Management, 10(15), 373-392*
- Mburu, D.K. (2013). *Effects of technological innovations on financial performance of commercial banks in Kenya.* Unpublished MBA Project, University of Nairobi

- Mises, J. (1912). Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy*, 98 (5): 1076-1107.
- Muchiri, F. (2017). *Strategic alternative banking channels and performance of commercial banks in Kenya*. An unpublished MBA Project, University of Nairobi.
- Mulwa, F. (2017). *Effect of internet banking on financial performance of commercial banks in Kenya*. An unpublished MBA Project, University of Nairobi.
- Munyoki, T. N. (2013). *Effect of online banking on financial performance of commercial banks in Kenya*. Unpublished MBA Project, University of Nairobi
- Mutua R. W. (2010). *Effects of mobile banking on the financial Performance of commercial banks in Kenya*, Unpublished MBA Thesis, University of Nairobi.
- Mwangi, M. & Murigu, J. (2015). The Determinants of Financial Performance in General Insurance Companies in Kenya. *European Scientific Journal*, 11(1), 288 – 297
- Mwangi, M., & Angima, C. (2016). Actuarial Risk Management Practices and Financial Performance of Property and Casualty Insurance Firms: Identification of a Moderating Variable. *International Journal of Humanities and Social Science*, 6(2), 126 – 132
- Mwania, M., & Muganda, N. (2011). An investigation on the relationship between information technology (IT) conceptualization and bank performance. School of Computer Science & Information Technology, Kimathi University College of Technology, Kenya, *AIBUMA Conference paper, 2011*.
- Njogu, J. N. (2014). *The Effect of Electronic Banking on Profitability of Commercial Banks in Kenya*. Unpublished MBA Project, University of Nairobi.
- Njoroge, A. (2014). *Relationship between capital structure and financial performance*. An unpublished masters project from the University of Nairobi
- Nofie, I. (2011). The diffusion of electronic banking in Indonesia, *Manchester Business School Business Review*, 70, 65-82.



- Nyamita, M. O. (2014). *Factors Influencing Debt Financing and Its Effects on Financial Performance of State Corporations in Kenya*. Doctorate Thesis. Durban University of Technology.
- Ocharo, W. & Muturi, W. (2016). Effect of alternative banking channels on profitability of commercial banks a case study of commercial banks in Kisii County, Kenya. *International Journal of Economics, Commerce and Management United Kingdom*, 4(4), 12-19
- Ogare, H. O. (2001). *Effect of Electronic Banking on Financial Performance of Commercial Banks in Kenya*. Unpublished MBA project University of Nairobi.
- Okiro, K. & Ndung'u, J. (2013). The Impact of Mobile and Internet Banking on Performance of Financial Institutions in Kenya. *European Scientific Journal* 9(13): 1857-7431
- Oloo, O., (2007). *Banking Into the Future*. The Banking Survey Kenya
- Omondi, O. M. & Muturi, W. (2013). Factors Affecting the Financial Performance of Listed Companies at the Nairobi Securities Exchange in Kenya. *Research Journal of Finance and Accounting*, 4 (15), 99 – 104.
- Ongore V.O and Kusa G.B (2013). Determinants of Financial Performance of Commercial Banks in Kenya. *International Journal of Economics and Financial Issues*, 3(1), 237-252.
- Pooja, M., & Balwinder, S. (2009). The impact of internet banking on bank performance and risk: The Indian experience. *Eurasian Journal of Business and Economics*, 2 (4), 43- 62.
- Rao, K. R. M., & Lakew, T. B. (2012). Determinants of Profitability of Commercial Banks in a Developing Country: Evidence from Ethiopia, *International Journal of Accounting and Financial Management Research*, 2(3), 1-20
- Roberts, P. W., & Amit, R. (2003). The Dynamics of Innovative Activity and Competitive Advantage: The case of Australian retail banking, 1981 to 1995. *Organization Science*, 14 (2), 107-122.

- Stoica, O., Mehdian, S., & Sargu, A. (2015). The impact of internet banking on the performance of Romanian banks: DEA and PCA approach. *Procedia Economics and Finance*, 20, 610-622.
- Sun H. & Zhang P. (2006). The role of moderating factors in user technology acceptance, *Journal of Human-Computer Studies*, 64(1), 53-78
- Tchouassi, G. (2012). Can Mobile Phones Really Work to Extend Banking Services to the Unbanked? Empirical Lessons from Selected Sub-Saharan Africa Countries, *International Journal of Development Societies*, 1, (2), 2012, 70-81
- Tiwari, R. Buse, S., & Herstatt, C. (2006). Mobile banking as business strategy: impact of mobile technologies on customer behaviour and its implications for banks, mobile banking as business strategy: Impact of mobile technologies on customer behaviour and its implications for banks. *Working Paper No. 37*.
- Upton, D.M., Kim, B. (1999). Alternative Methods of Learning and Process Improvement in Manufacturing, *Journal of Operations Management*, 16, 1-20.
- Wachira, V. (2013). *Effects of technological innovation on the performance of commercial banks in Kenya*. Unpublished MBA research project, University of Nairobi.
- Waithanji, M.N. (2016). *Effect of agent banking as a financial deepening initiative in Kenya*. MBA Project, University of Nairobi.
- Wambari, P. A. M (2009). *Mobile banking in developing countries. A case study on Kenya*. Unpublished Master's Thesis, University of Capetown
- Wernerfelt B. (1984). Alternative Methods of Learning and Process Improvement in Manufacturing, *Journal of Operations Management*, 16, 1-20.
- Xu, M. & Wanrapee, B. (2014). *Factors Affecting Financial Performance of Firms Listed on Shanghai Stock Exchange*. Unpublished MSc Project, University of Thai

- Yahaya, O. A. & Lamidi, Y. (2015). Empirical Examination of the Financial Performance of Islamic Banking in Nigeria: A Case Study Approach. *International Journal of Accounting Research*, 2(7), 1 – 13.
- Yilmaz, C., Alpkın, L. & Ergun, E. (2005). Cultural determinants of customer- and learning- oriented value systems and their joint effects on firm performance. *Journal of Business Research*; 58 (10): 1340- 52.

## APPENDICES

### **Appendix I: List of Commercial Banks in Kenya as at 31<sup>st</sup> December 2018**

1. ABC Bank (Kenya)
2. Bank of Africa
3. Bank of Baroda
4. Bank of India
5. Barclays Bank of Kenya
6. Chase Bank Kenya (In Receivership)
7. Citibank
8. Commercial Bank of Africa
9. Consolidated Bank of Kenya
10. Cooperative Bank of Kenya
11. Credit Bank
12. Development Bank of Kenya
13. Diamond Trust Bank
14. Dubai Islamic Bank
15. Ecobank Kenya
16. Equity Bank
17. Family Bank
18. First Community Bank
19. Guaranty Trust Bank Kenya
20. Guardian Bank
21. Gulf African Bank
22. Habib Bank AG Zurich
23. Housing Finance Company of Kenya
24. I&M Bank
25. Imperial Bank Kenya (In receivership)
26. Jamii Bora Bank
27. Kenya Commercial Bank
28. Mayfair Bank
29. Middle East Bank Kenya

30. National Bank of Kenya
31. NIC Bank
32. Oriental Commercial Bank
33. Paramount Universal Bank
34. Prime Bank (Kenya)
35. SBM Bank Kenya Limited
36. Sidian Bank
37. Spire Bank
38. Stanbic Bank Kenya
39. Standard Chartered Kenya
40. Trans National Bank Kenya
41. United Bank for Africa
42. Victoria Commercial Bank

**Source: CBK (2019)**

## Appendix II: Research Data

Bank	Year	Cost efficiency	Mobile banking	Asset quality	Liquidity	Bank size
ABC Bank	2014	1.6136	5.4560	0.05068	0.8514	16.91
	2015	1.4790	5.2474	0.14259	0.9676	16.934
	2016	1.5616	5.9094	0.15660	0.8750	16.945
	2017	1.6086	6.9406	0.18290	0.7638	17.058
	2018	1.5700	6.3276	0.19890	0.7855	17.145
Bank of Africa	2014	1.6621	6.4095	0.04750	0.8776	18.16
	2015	1.8329	5.4893	0.23249	0.7960	18.054
	2016	1.7753	4.5126	0.26057	0.9152	17.841
	2017	1.9786	4.5192	0.28161	0.8675	17.808
	2018	2.3164	6.0738	0.33834	0.7034	17.709
Bank of Baroda	2014	2.8807	5.0277	0.04399	0.4417	17.942
	2015	2.4023	4.5839	0.07544	0.5362	18.038
	2016	2.2776	2.6015	0.08456	1.0000	18.233
	2017	2.2776	2.4961	0.05864	1.0000	18.381
	2018	3.3098	2.0579	0.09870	0.8940	18.628
Barclays Bank	2014	1.8006	4.9766	0.03631	0.7624	19.235
	2015	1.6517	4.0027	0.00538	0.8834	19.3
	2016	1.5413	4.1684	0.00949	0.9457	19.375
	2017	1.6127	4.2325	0.01137	0.9055	19.42
	2018	1.8343	4.8365	0.01840	0.8551	19.6
Bank of India	2014	2.7772	4.0864	0.00559	0.5017	17.353
	2015	2.3611	3.4454	0.02025	0.7255	17.557
	2016	2.4844	2.9792	0.01394	0.7201	17.683
	2017	2.7436	2.8266	0.02072	0.6598	17.852
	2018	34.3171	3.2140	0.71960	0.0450	17.954
Citibank	2014	3.3066	2.8327	0.02376	0.4694	18.19
	2015	3.3103	3.2471	0.05802	0.4293	18.295
	2016	3.7659	3.2551	0.01920	0.4391	18.453
	2017	2.6415	3.2571	0.03681	0.5777	18.403
	2018	3.2395	2.9117	0.01622	0.4825	18.266
Commercial Bank of Africa	2014	2.2097	6.3836	0.07083	0.6449	19.101
	2015	2.0829	6.5262	0.10589	0.6294	19.189
	2016	2.0540	6.8635	0.07455	0.6305	19.251
	2017	2.1627	7.4155	0.08310	0.5865	19.32
	2018	2.0173	7.1211	0.07975	0.6183	19.317
Consolidated bank	2014	1.6366	7.3715	0.11953	0.8657	16.529
	2015	1.5329	7.6194	0.05533	0.9225	16.464

<b>Bank</b>	<b>Year</b>	<b>Cost efficiency</b>	<b>Mobile banking</b>	<b>Asset quality</b>	<b>Liquidity</b>	<b>Bank size</b>
	2016	1.5192	9.4803	0.11757	0.9652	16.449
	2017	1.5979	14.5375	0.15274	0.9740	16.415
	2018	1.5288	27.5217	0.15330	0.9815	16.372
Credit bank	2014	1.6037	6.1939	0.08241	0.7663	15.998
	2015	1.4514	5.2257	0.06383	0.9753	16.146
	2016	1.5492	3.7019	0.07218	0.8647	16.32
	2017	1.4962	4.4401	0.07536	0.8865	16.49
	2018	1.3740	4.8210	0.07242	0.9934	16.701
Co-operative bank of Kenya	2014	1.5901	3.9201	0.01884	0.8245	19.469
	2015	1.6421	0.4188	0.01585	0.7859	19.652
	2016	1.3524	3.5656	0.02240	1.0026	19.679
	2017	1.3462	3.5234	0.03460	1.0063	19.774
	2018	1.6856	5.1499	0.04136	0.8017	19.841
Development Bank of Kenya	2014	1.5492	2.9876	0.26987	1.3340	16.245
	2015	1.4962	2.8745	0.26321	1.4480	16.185
	2016	1.8792	2.8578	0.26011	1.5140	16.613
	2017	1.7728	3.2807	0.20983	1.4772	16.607
	2018	2.0323	3.5498	0.20786	1.7430	16.805
Diamond Trust Bank	2014	1.5367	5.3122	0.01165	0.8552	19.17
	2015	1.5298	7.7421	0.02408	0.9149	19.42
	2016	1.7608	7.0228	0.03249	0.7824	19.609
	2017	1.8531	6.8637	0.06657	0.7363	19.711
	2018	1.9563	6.2715	0.06290	0.6826	19.75
Dubai bank	2014	1.5492	0.9877	0.00327	0.7255	17.557
	2015	1.4962	0.9358	0.00765	0.7201	17.683
	2016	2.0323	0.9487	0.00456	0.6598	17.852
	2017	8.9815	0.9311	0.00000	0.2460	14.775
	2018	2.4632	2.7198	0.00373	0.6666	15.474
Ecobank	2014	1.9987	3.0884	0.08711	0.7090	17.643
	2015	1.7699	3.4812	0.06217	0.8591	17.775
	2016	1.9255	4.2393	0.16282	0.7590	17.668
	2017	3.2653	7.2867	0.37696	0.3747	17.794
	2018	4.1822	7.7987	0.17352	0.2910	17.813
Equity Bank	2014	1.6089	3.8259	0.03432	0.8728	19.658
	2015	1.5860	3.9885	0.02715	0.8932	19.875
	2016	1.7804	4.0750	0.06283	0.7891	19.976

<b>Bank</b>	<b>Year</b>	<b>Cost efficiency</b>	<b>Mobile banking</b>	<b>Asset quality</b>	<b>Liquidity</b>	<b>Bank size</b>
	2017	1.8792	4.1173	0.05533	0.7479	20.078
	2018	1.9291	4.6648	0.04868	0.7031	20.167
Family bank	2014	1.1071	3.3648	0.01954	1.1849	17.94
	2015	2.1432	5.8993	0.03673	0.6048	18.213
	2016	1.3853	2.8648	0.11967	1.2118	18.057
	2017	1.5903	3.6026	0.19231	0.9179	18.052
	2018	1.5191	3.8100	0.16175	0.9099	18.02
First Community Bank	2014	1.5645	9.3715	0.15058	0.7321	16.542
	2015	1.3313	8.1399	0.23456	0.8858	16.494
	2016	1.3678	6.4282	0.31954	0.8644	16.521
	2017	1.7848	7.3119	0.40781	0.6584	16.67
	2018	1.9807	13.5594	0.48817	0.6175	16.699
Guaranty Trust Bank	2014	2.3545	4.0927	0.12962	0.6570	17.634
	2015	2.0893	3.3452	0.09162	0.7435	17.528
	2016	1.6545	3.3163	0.11079	0.7150	17.286
	2017	1.5518	3.2891	0.10884	0.7444	17.277
	2018	1.9279	3.4241	0.14667	0.6861	17.452
Guardian Bank	2014	1.5446	7.2033	0.01256	0.7463	16.495
	2015	1.5807	6.2961	0.03041	0.7398	16.497
	2016	1.6386	5.7282	0.01690	0.7289	16.504
	2017	1.6432	5.5243	0.04526	0.7331	16.576
	2018	1.7929	5.2142	0.04939	0.6771	16.6
Gulf African Bank	2014	1.4321	5.0178	0.06500	0.8734	16.799
	2015	1.6014	4.9045	0.08421	0.8113	17.023
	2016	1.6770	5.0998	0.09227	0.7443	17.117
	2017	1.6156	5.3914	0.09286	0.7434	17.26
	2018	1.4742	4.3556	0.00000	0.8470	17.322
Habib Bank Ltd	2014	2.0323	3.9877	0.07529	0.7331	16.576
	2015	2.5924	3.6966	0.07916	0.5751	16.141
	2016	3.2808	3.8416	0.18709	0.4641	16.342
	2017	1.5492	3.8765	0.17985	1.3509	18.028
	2018	1.4962	3.8546	0.17835	1.2511	17.919
Housing finance Company ltd	2014	1.3474	2.1218	0.06130	1.2531	17.926
	2015	1.3515	4.3638	0.04374	1.2726	18.087
	2016	1.3206	4.0405	0.06925	1.4072	18.091
	2017	1.3606	4.0337	0.10809	1.3509	18.028



<b>Bank</b>	<b>Year</b>	<b>Cost efficiency</b>	<b>Mobile banking</b>	<b>Asset quality</b>	<b>Liquidity</b>	<b>Bank size</b>
	2018	1.3939	4.3374	0.24938	1.2511	17.919
<b>I&amp;M Bank</b>	2014	1.5687	4.9950	0.00990	0.9850	18.989
	2015	1.4999	4.7633	0.02481	0.9612	19.072
	2016	1.5633	5.4397	0.02890	0.9192	19.165
	2017	1.5692	5.2528	0.08697	0.9039	19.297
	2018	1.7304	6.0393	0.07731	0.7823	19.48
<b>Jamii Bora Bank Ltd</b>	2014	2.1193	3.7325	0.08294	0.7295	16.389
	2015	1.6524	4.7598	0.05175	0.9278	16.636
	2016	1.6865	2.8938	0.17197	1.1594	16.574
	2017	1.5501	2.2742	0.13310	1.5554	16.371
	2018	2.0323	2.3687	0.13387	1.5539	16.258
<b>KCB Bank</b>	2014	1.7282	5.2980	0.03128	0.7521	20.011
	2015	1.6131	6.9490	0.04459	0.8152	20.14
	2016	1.5431	4.8501	0.07052	0.8607	20.204
	2017	1.5299	5.4196	0.07658	0.8461	20.287
	2018	1.5669	4.5241	0.06268	0.8482	20.387
<b>Middle East Bank (K) Ltd</b>	2014	1.5492	3.3798	0.15786	0.7856	15.356
	2015	1.4962	3.3756	0.15498	0.8798	15.287
	2016	1.4471	3.3689	0.15898	0.9050	15.471
	2017	1.8494	3.3780	0.18068	0.7086	15.449
	2018	2.0938	3.7281	0.38247	0.6175	15.495
<b>M-Oriental bank ltd</b>	2014	2.0323	2.3876	0.08762	0.4578	16.128
	2015	2.0323	2.2784	0.08235	0.9569	17.234
	2016	2.0323	2.4879	0.08213	0.9569	16.11
	2017	2.0323	2.5832	0.07179	0.9745	16.174
	2018	2.0323	2.7594	0.09399	1.0131	16.168
<b>National Bank of Kenya</b>	2014	1.5492	9.3464	0.11897	0.6267	18.628
	2015	1.4962	10.5042	0.11163	0.6129	18.647
	2016	1.4945	15.0797	0.17494	0.5861	18.535
	2017	1.4543	19.7551	0.30008	0.5554	18.515
	2018	1.4016	28.8039	0.39131	0.4833	18.559
<b>NIC Plc bank</b>	2014	1.8752	3.4216	0.01344	1.0014	18.798
	2015	1.8500	3.4759	0.09116	1.0204	18.926
	2016	2.0372	3.1303	0.11256	1.0236	18.948
	2017	2.0984	3.5777	0.10887	0.8621	19.144
	2018	2.4038	4.6829	0.12239	0.8087	19.155
<b>Paramount Bank</b>	2014	1.4495	5.8506	0.06606	0.5526	16.158

<b>Bank</b>	<b>Year</b>	<b>Cost efficiency</b>	<b>Mobile banking</b>	<b>Asset quality</b>	<b>Liquidity</b>	<b>Bank size</b>
Ltd						
	2015	1.4459	5.2674	0.05193	0.7279	16.169
	2016	1.4804	4.6804	0.08276	0.7565	16.059
	2017	1.7215	4.4603	0.10561	0.7639	16.071
	2018	1.7835	5.1580	0.13184	0.6948	16.107
Prime Bank	2014	2.3389	6.6853	0.01339	0.7673	17.821
	2015	1.7926	6.0840	0.01700	0.8077	17.99
	2016	1.6256	4.5809	0.03617	0.7981	17.995
	2017	1.6166	4.8563	0.04864	0.6802	18.172
	2018	1.7521	3.5406	0.06063	0.5174	18.422
Sidian Bank	2014	1.5927	5.0719	0.07427	0.8664	16.576
	2015	1.5836	3.5339	0.12841	0.9357	16.766
	2016	1.6601	3.5849	0.23826	0.9817	16.854
	2017	2.0014	3.8051	0.27798	0.8941	16.776
	2018	2.7228	4.3527	0.20351	0.7753	17.047
Stanbic Bank Kenya Ltd	2014	1.5492	3.4897	0.03786	0.7652	19.487
	2015	1.4962	3.5006	0.02315	0.9881	19.155
	2016	1.9886	3.6631	0.02710	0.9687	19.185
	2017	2.6212	4.4328	0.02115	0.8440	19.332
	2018	5.7884	4.8433	0.01408	0.7652	19.487
Standard Chartered Bank	2014	1.5116	4.2456	0.07240	0.7967	19.22
	2015	1.5262	4.2851	0.10147	0.6692	19.271
	2016	1.5539	4.4319	0.08285	0.6576	19.339
	2017	1.6918	5.0506	0.08961	0.5920	19.471
	2018	1.9269	5.3686	0.11691	0.5290	19.469
Spire Bank Ltd	2014	2.0323	9.9221	0.25083	0.7038	16.624
	2015	1.9856	5.1043	0.33316	0.8019	16.488
	2016	1.8573	4.5089	0.16767	0.8702	16.44
	2017	1.9055	5.6499	0.42705	0.7686	16.227
	2018	1.9820	4.2675	0.55979	0.6667	16.037
Transnational Bank	2014	1.8126	4.0003	0.08807	0.7846	16.142
	2015	2.0323	3.7301	0.11030	0.8769	16.162
	2016	2.0412	3.8426	0.11561	0.7959	16.155
	2017	2.2624	2.6520	0.24155	0.8361	16.142
	2018	2.4054	4.1578	0.26962	0.8263	16.141
UBA Kenya Bank Ltd	2014	1.6478	3.1399	0.06297	0.2053	15.375

<b>Bank</b>	<b>Year</b>	<b>Cost efficiency</b>	<b>Mobile banking</b>	<b>Asset quality</b>	<b>Liquidity</b>	<b>Bank size</b>
	2015	1.7388	3.6968	0.01798	0.6607	15.867
	2016	1.8568	0.9085	0.01856	1.5704	15.539
	2017	2.1279	1.3845	0.04357	1.0925	15.688
	2018	2.0746	2.7776	0.12763	0.5709	16.545
Victoria Commercial Bank	2014	1.7040	3.1790	0.00034	0.8361	16.142
	2015	1.5720	3.1876	0.02793	0.7652	19.487
	2016	1.6290	3.1467	0.00000	0.9743	16.925
	2017	1.5507	3.3852	0.00080	1.0103	17.073
	2018	1.5449	3.8286	0.03083	0.9504	17.292